Docket No.: 57454-248

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of	:	Customer Number: 20277
Shuji NAKAO, et al.	:	Confirmation Number: 4719
Application No.: 09/986,084	:	Group Art Unit: 1756
Filed: November 7, 2001	:	Examiner: C. Young

For: FOCUS MONITORING METHOD, FOCUS MONITORING APPARATUS, AND METHOD OF MANUFACTURING SEMICONDUCTOR DEVICE

TRANSMITTAL OF APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith in triplicate is Appellant's Appeal Brief in support of the Notice of Appeal filed December 23, 2003. Please charge the Appeal Brief fee of $330.00 to Deposit Account 500417.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT, WILL & EMERY

Scott D. Paul
Registration No. 42,984

#26,106

600 13th Street, N.W.
Washington, DC 20005-3096
(202) 756-8000 SDP:kap
Date: February 23, 2004
Facsimile: (202) 756-8087

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Docket No.: 50090-288 PATENT

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APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is submitted in support of the Notice of Appeal filed December 23, 2003.

I. REAL PARTY IN INTEREST

The real party in interest is Renesas Technology Corp.

II. RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any related appeals and interferences.

III. STATUS OF CLAIMS

Claims 1-9 are pending and have been finally rejected in this application. It is from the final rejection of claims 1-9 that this Appeal is taken.

IV. STATUS OF AMENDMENTS

No amendments to the claims have been filed subsequent to the Final Office Action dated September 29, 2003.

V. SUMMARY OF INVENTION

The present invention addresses and solves photolithography resolution problems. Resolution (R) is represented by the equation $R = k_1 * \lambda / (NA)$ (page 1 of the written description of the specification, line 32 through page 2, line 4). Problems arise in that it is technically difficult to improve a light source and a lens, and that the shorter wavelength and the higher NA may make the depth of focus ($\delta = k_2 * \lambda / (NA)^2$) shallower, resulting in lower resolution (page 2, lines 5-13). In order to obtain a high resolution, exposure must be carried out by adjusting the photoresist to the best image-forming plane (i.e., best focus plane) of the projection optical system within a range of the depth of focus (page 2, lines 14-20).

A certain conventional method addressing these problems requires a photomask with a special structure, which increases the cost of the photomask (page 4, lines 14-17). Such a photomask requires formation of microscopic diffraction grating pattern on the rear surface of the photomask, which requires a number of step that significantly increases the cost of the mask (page 4, lines 18-22). Other problems with using the conventional photomask include difficulty

informing patterns and a restricted illumination range (page 4, lines 23-33). Therefore, a need existed for a focus monitoring method that negates the use of a special structure for the photomask.

According to the present invention, per independent claim 1, a light is directed onto a photomask by non-telecentric illumination, which is obtained by controlling the shape of an opening of an illumination aperture. Use of non-telecentric illumination enables defocus to be more readily detected (page 5, line 14 through page 6, line 1), which can then be corrected. This allows for an inexpensive and highly precise focus monitor process. The claimed invention, thus, constitutes an improvement over conventional focus monitoring processes.

VI. ISSUES

The Issues Which Arise In This Appeal And Require Resolution By The Honorable Board of Patent Appeals And Interferences (The Board) Is:

1. Whether claims 8 and 9 are unpatentable under 35 U.S.C. § 102 for anticipation based upon Hirukawa, JP 6-120116; and

2. Whether claims 1-7 are unpatentable under 35 U.S.C. § 103 for obviousness based upon Hirukawa in view of King et al., U.S. Patent No. 5,952,132 (hereinafter King).

VII. GROUPING OF CLAIMS

The appealed claims do not stand or fall together. Claims 1-7 and 9 stand or fall together as a group with claim 1; the separate patentability of claim 8 is argued.

VIII. THE ARGUMENT

THE REJECTION OF CLAIMS 8 AND 9 UNDER 35 U.S.C. § 102 AS BEING ANTICIPATED BY HIRUKAWA

The Examiner's Argument:

In the first Office Action dated May 27, 2003, the Examiner's sole statement in support of the rejection of claims 7 and 8 is as follows:

> The focus monitoring apparatus used for pattern formation of a semiconductor device as claimed is clearly described, shown and suggested by the Japanese document. See specifically the Figures and Abstract of the Disclosure.

In responding to Appellants' arguments that the Examiner has failed to clearly designate the teachings in Hirukawa that identically discloses each element of the claimed invention, the Examiner stated the following in the final Office Action dated September 29, 2003:

> The focus monitoring apparatus used for pattern formation of a semiconductor device as claimed is still clearly described, shown and suggested by the Japanese document. See specifically the Figures and Abstract of the Disclosure. (emphasis added)

Appellants' Response:

Notwithstanding Appellants' arguments that the Examiner has not specifically identified where Hirukawa identically discloses each element of the claimed invention, the Examiner has merely repeated his assertion word-for-word except for adding the term "still" in the phrase "a semiconductor device as claimed is still clearly described ...".

As argued in the Request for Reconsideration filed August 27, 2003, the factual determination of lack of novelty under 35 U.S.C. § 102 requires the identical disclosure of each element of a claimed invention in a single reference. As part of this analysis, the Examiner must (a) identify the elements of the claims, (b) determine the meaning of the elements in light of the

specification and prosecution history, and (c) identify corresponding elements disclosed in the allegedly anticipating reference. Furthermore, the Examiner is burdened to clearly designate the teachings in Hirukawa being relied upon and/or clearly explain the pertinence of Hirukawa per 37 C.F.R. § 1.104(c).[1] The Examiner, however, has not met any of these requirements.

By failing to identify the elements of the claims; construe a meaning for these elements; and identify where these elements are disclosed by the applied reference, the Examiner has forced Appellants to guess as to how the Examiner is interpreting the elements of the claims and guess as to what features the Examiner believes identically discloses the claimed invention. Thus, the Examiner is essentially placing a burden on Appellants to prove that Hirukawa does not disclose the claimed elements based upon Appellants' interpretation of the claims and Appellants' comparison of the claims with the applied prior art. This shifting of the Examiner's burden to the Appellants to establish patentability, however, is premature since the Examiner has still not established his prima facie burden.[2]

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[1] 37 C.F.R. § 1.104(c) provides:

> In rejecting claims for want of novelty or for obviousness, the examiner must cite the best references at his or her command. When a reference is complex or shows or describes inventions other than that claimed by the applicant, the particular part relied on must be designated as nearly as practicable. The pertinence of each reference, if not apparent, must be clearly explained and each rejected claim specified.

[2] Appeal No. 1997-2981. Appellants note that in the unpublished opinion of Ex parte Pryor, the Board previously addressed the issue of an Examiner not supplying sufficient information to establish a prima facie case of anticipation. Specifically, the Board wrote:

> At the outset, we note the examiner has been of little help in particularly explaining the rejections on appeal. A mere statement that claims stand rejected "as being clearly anticipated by" a particular reference, without any further rationale, such as pointing out corresponding elements between the instant claims and the applied reference, fails to clearly make out a prima facie case of anticipation. (emphasis in original).

Notwithstanding the Examiner's failure to establish a prima facie case of anticipation, Appellants note that claim 8 recites "directing non-telecentric illuminating light obtained by controlling a shape of an opening of an illumination aperture included in said illumination optical system onto said photomask." Referring to page 10, lines 16-22 of the Appellants' specification, "non-telecentric illumination" is defined as illumination that is not telecentric illuminated, and more specifically, is defined as illumination in which the intensity distribution of the illuminating light is asymmetric with respect to the optical axis of the illumination optical system (illumination in which the barycenter in the intensity distribution of the illuminating light is off the optical axis).

Referring to Figs. 1 and 2 of Hirukawa, the pattern 25/28 of the mask 17A/17B is illumination with the exposure light having a principal ray inclined with respect to the optical axis of the projection system 19. In order to incline the principal ray of the exposure light with respect to the optical axis, the diffraction grating pattern 29 is provided on the upper surface of the mask 17/17C in Hirukawa, as shown in Figs. 4 and 5. By directing primary diffracting light produced by the diffraction grating pattern 29 onto the mark (18A, 18B or 18C, 18D), the mark is illuminated with the exposure light having a principal ray included with respect to the optical axis. Hirukawa does not teach using non-telecentric illumination obtained by controlling a shape of an opening of an illumination aperture included in the illumination optical system, as recited in claim 8, and thus, Hirukawa fails to identically disclose the claimed invention within the meaning of 35 U.S.C. § 102.

THE REJECTION OF CLAIMS 1-7 UNDER 35 U.S.C. § 103 FOR OBVIOUSNESS BASED UPON HIRUKAWA IN VIEW OF KING

The Examiner's Argument:

In the first Office Action dated May 27, 2003, the Examiner stated the following regarding the disclosure of Hirukawa:

> A careful review of the Figures and translation show that non-telecentric illumination is utilized to perform focus monitoring of the patterned image of the photomask.

After discussing that Hirukawa is not clear as to the specific type of mask patterns utilized, the Examiner then goes on to write:

> Although King et al. does not describe non-telecentric illumination, one of ordinary skill would have found it prima facie obvious to utilize the best focus measuring method of the Japanese document in combination with the box within a box mark with a reasonable expectation of achieving a highly useful focus measuring method as set forth in the Japanese document absent objective evidence of high probative value to the contrary.

In responding to Appellants' arguments that the Examiner has failed to clearly designate the teachings in Hirukawa and King that identically discloses each element of the claimed invention and the Examiner has not supplied a realistic motivation to modify Hirukawa in view of King, the Examiner stated the following in the final Office Action dated September 29, 2003:

> The broad scope of protection sought is described, taught and suggested by the Japanese document as discussed in paragraph 4 of the previous Office Action (P.N. 5). All comments presented in the previous reject are incorporated by reference herein, and the rejection is repeated.

Appellants' Response:

As evident from the Examiner comments in the Office Action dated September 29, 2003, the Examiner did not address **any** of the issues raised by Appellants in the Request for Reconsideration filed August 27, 2003. Claim 1 also includes the limitation of "directing non-telecentric illuminating light obtained by controlling a shape of an opening of an illuminating aperture onto the photomask" (emphasis added), and Hirukawa's failure to disclose using non-

telecentric illuminating light is discussed above with regard to the rejection under 35 U.S.C. § 102. Hirukawa also fails to teach controlling a shape of an opening of an illuminating aperture, and the Examiner has failed to establish that this feature is disclosed by either Hirukawa or King. Thus, even if the applied prior art were combined in the manner suggested by the Examiner, the claimed invention would not result.

With regard to the teachings of King, the Examiner stated:

> However, King et al. describes a method of forming a stepper focus pattern through determination of overlay error that is extremely similar to the focus monitoring method of the instant application and that of the Japanese document relied upon by the Examiner. In the document of King et al., it is shown that a box with a box pattern is utilized, with relative displacement of the patterns transferred onto the photoresist to perform focus monitoring.

This is the only statement made by the Examiner regarding the features in King being relied upon by the Examiner, and thus, the Examiner's rejection does not comply with 37 C.F.R. § 1.104(c) since the Examiner has failed to clearly designate the teachings in Hirukawa being relied or clearly explain the pertinence of Hirukawa. In particular, Appellants note that the Examiner has failed to establish where all of the claimed features are taught or suggested by either Hirukawa or King.

Appellants also submit that the Examiner has not established a prima facie of obviousness for lack of the requisite factual basis and lack of the requisite realistic motivation.[3] In condensing the Examiner's arguments, the Examiner is arguing that it would have been obvious

[3] In rejecting a claim under 35 U.S.C. § 103, the Examiner is required to identify a source in the applied prior art for: (1) claim limitations; and (2) the motivation to combine references or modify a reference in the reasonable expectation of achieving a particular benefit. Smiths Industries Medical System v. Vital Signs Inc., 183 F.3d 1347, 51 USPQ2d 1415 (Fed. Cir. 1999). The requisite motivation to support the ultimate legal conclusion of obviousness under 35 U.S.C. § 103 is not an abstract concept, but must stem from the applied prior art as a whole and have realistically impelled one having ordinary skill in the art to modify a specific reference to arrive at a specifically claimed invention. In re Deuel, 51 F.3d 1552, 34 USPQ2d 1210 (Fed. Cir. 1995); In re Newell, 891 F.2d 899, 13 USPQ2d 1248 (Fed. Cir. 1989).

to use the features of King with Hirukawa to achieve a highly useful focus measuring method absent "objective evidence of high probative value to the contrary." There is, however, no factual basis for these assertions. The Examiner's assertion that one having ordinary skill in the art would have "a reasonable expectation of achieving a highly useful focus measuring method" is a conclusory statement without any basis in fact. The Examiner has already admitted that King does not describe non-telecentric illumination, and the Examiner has failed to establish that one having ordinary skill in the art would recognize that a method useful in telecentric illumination can also be used in applications using non-telecentric illuminations. Therefore, there is no factual basis for the Examiner's conclusion that one having ordinary skill in the art would enjoy a reasonable expectation of success in combining these two different methods.

Furthermore, the Examiner's statement of "absent objective evidence of high probative value to the contrary" is akin to putting the cart before the horse. As previously discussed with regard to rejections under 35 U.S.C. § 102, the initial burden of proof is on the Examiner, and not the Appellants. The same holds true for a rejection under 35 U.S.C. § 103. Appellants are under no burden to produce any evidence prior to the Examiner establishing a prima facie case of obviousness. As discussed above, the Examiner's arguments as to the obviousness of the claimed invention are not based on facts of record but on the Examiner's unsupported conclusions. Thus, the Examiner's requirement that Appellants submit "objective evidence of high probative value to the contrary" is premature since the Examiner has failed to establish a prima facie case of obviousness. For the reasons stated above, Appellants submit that the imposed rejection of claims 1-7 under 35 U.S.C. § 103 for obviousness based upon Hirukawa in view of King is not factually or legally viable.

IX. CONCLUSION

It should, therefore, be apparent that the Examiner did not discharge the initial burden of establishing a prima facie case of obviousness under 35 U.S.C. § 103 or anticipation under 35 U.S.C. § 102. Appellants, therefore, respectfully submit that the imposed rejection of claims 8 and 9 for anticipation and the rejection of claims 1-7 obviousness are not viable and, hence, Appellants solicit withdrawal thereof.

X. PRAYER FOR RELIEF

Based upon the foregoing, Appellant, therefore, respectfully solicits the Honorable Board to reverse the Examiner's rejection of claims 8 and 9 under 35 U.S.C § 102 and the Examiner's rejection of claims 1-7 under 35 U.S.C. § 103.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper,

including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT, WILL & EMERY

Scott D. Paul
Registration No. 42,984

#26,106

600 13th Street, N.W.
Washington, DC 20005-3096
(202) 756-8000 SDP/AJS:kap
Date: February 23, 2004
Facsimile: (202) 756-8087

APPENDIX

1. A focus monitoring method used for pattern formation of a semiconductor device, characterized in that

light is directed onto a photomask by non-telecentric illumination obtained by controlling a shape of an opening of an illumination aperture, and such a characteristic is utilized to perform focus monitoring that a pattern image of said photomask formed by said illumination is moved in a direction perpendicular to an optical axis when an image-forming plane is moved in a direction of said optical axis.

2. The focus monitoring method according to claim 1, wherein a mark pattern of a box-in-box type having an outer box pattern and an inner box pattern is transferred onto a photoresist, and a relative displacement of said outer box pattern and said inner box pattern transferred onto said photoresist is detected, to perform focus monitoring.

3. The focus monitoring method according to claim 2, wherein said non-telecentric illumination is used for exposure of at least one of said outer box pattern and said inner box pattern.

4. The focus monitoring method according to claim 3, wherein

said non-telecentric illumination is used for exposure of both of said outer box pattern and said inner box pattern,

a first illumination aperture having an opening only on one side of a meridian plane set as a border is used at the time of exposure of said outer box pattern, and

a second illumination aperture having an opening only on the other side of the meridian plane set as a border is used at the time of exposure of said inner box pattern.

5. The focus monitoring method according to claim 4, wherein

one of a circular illumination apperture stop, an annular illumination apperture stop and a quadruple illumination apperture stop, with an opening left only on one side of the meridian plane set as a border, is used for said first illumination aperture, and

one of a circular illumination apperture stop, an annular illumination apperture stop and a quadruple illumination apperture stop, with an opening left only on the other side of the meridian plane set as a border, is used for said second illumination aperture.

6. The focus monitoring method according to claim 2, comprising:

a first exposure step exposing said photoresist to one of said outer box pattern and said inner box pattern;

a second exposure step exposing said photoresist to the other one of said outer box pattern and said inner box pattern; and

a development step developing said photoresist after said first and second exposure steps.

7. The focus monitoring method according to claim 2, comprising:

a first exposure step exposing said photoresist to one of said outer box pattern and said inner box pattern;

a first development step developing said photoresist after said first exposure step;

a second exposure step exposing said photoresist to the other one of said outer box pattern and said inner box pattern; and

a second development step developing said photoresist after said second exposure step.

8. A focus monitoring apparatus used for pattern formation of a semiconductor device, comprising:

an illumination optical system illuminating a photomask on which a pattern is formed with exposure light; and

a projection optical system projecting an image of the pattern of said photomask onto a photosensitive body,

said image of the pattern of said photomask, formed by directing non-telecentric illuminating light obtained by controlling a shape of an opening of an illumination aperture included in said illumination optical system onto said photomask, being configured to move in a direction perpendicular to an optical axis when an image-forming plane is moved in a direction of said optical axis.

9. A method of manufacturing a semiconductor device, characterized in that the focus monitoring method according to claim 1 is used.